电子元器件系列

www.rf-china.com **RF-Micom co.,Ltd**

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Sale Phone:86-592-5713956

Hybrid Couplers

3 dB, 90°

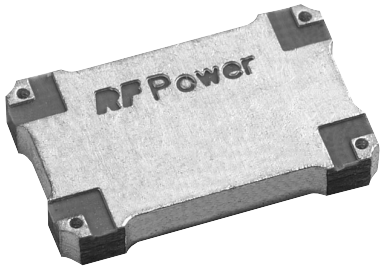
RF Power

Mini-RF Power Hybrids

Model	Frequency (MHz)	Power (W)
S03E1870N1	1750-1990	100
S03E1960N1	1930-1990	100
S03E2150N1	2100-2200	100
S03E2500N1	2000-3000	100
S03E2750N1	2500-3000	100

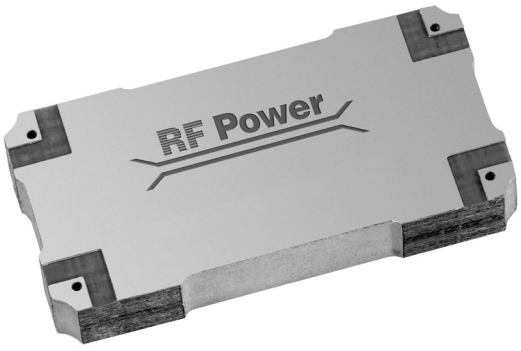
Cellular Band Hybrids

Model	Frequency (MHz)	Power (W)
S03A888N1	815-960	100
S03A1500W1	1000-2000	100
S03A1600N1	1500-1700	100
S03A1870N1	1750-1990	100
S03A1960N1	1930-1990	100
S03A2000N1	1500-2500	100
S03A2150N1	2100-2200	100
S03A2500N1	2000-3000	100
S03A2750N1	2500-3000	100



High Power

Model	Frequency (MHz)	Power (W)
S03B700W1	400-1000	100
S03B888N2	815-960	200
S03B1500N2	1000-2000	200
S03B1870N2	1750-1990	200
S03B1960N2	1930-1990	200
S03B2150N2	2000-2300	200
S03B888N3	815-960	300
S03B1870N3	1750-1990	300
S03B1960N3	1930-1990	300
S03B2150N3	2000-2300	300



VER. 4/5/02

Available on Tape and Reel for Pick and Place Manufacturing.

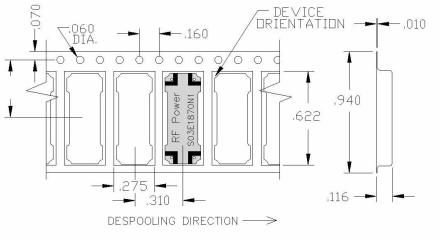
90º Hybrid Couplers

Xinger - RF Power Surface Mount Hybrid Cross Reference Guide

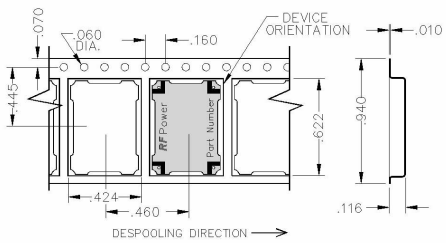
Below is a list of the RF Power hybrid couplers listed in this section with the comparable, meaning exact same footprint and very similar (if not identical) electrical specifications and similar, meaning not quite an exact drop-in solution whether it be electrical or mechanical incompatibiltiy, to the Xinger SMT hybrid coupler line. The RF Power product offering is an enhancement to the Xinger product line, and we recommend these RF Power components as a second source to the Xinger hybrid couplers or as a first source for your very high power hybrid coupler needs.

RF Power Model#	Comparable Xinger	Similar Xinger
S03E1870N1	1X503	N/A
S03E1960N1	N/A	1X503
S03E2150N1	JX503	N/A
S03E2500N1	N/A	1X603
S03E2750N1	N/A	N/A
S03A888N1	1D1304-3	1W1304-3
S03A1500W1	11305-3	N/A
S03A1600N1	1E1305-3	N/A
S03A1870N1	1A1305-3	N/A
S03A1960N1	1F1305-3	1A1305-3
S03A2000N1	1W1305-3	1A1305-3
S03A2150N1	N/A	1A1306-3
S03A2500N1	N/A	1A1306-3
S03A2750N1	N/A	N/A
S03B700W1	N/A	1F1304-3
S03B888N2	N/A	2D1304-3
S03B1500N2	N/A	2K1305-3
S03B1870N2	N/A	2A1305-3
S03B2150N2	N/A	2A1306-3

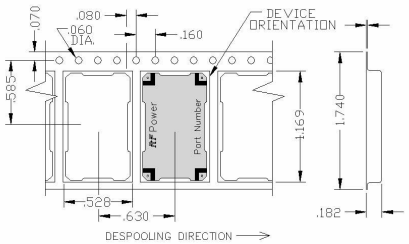
Tape & Reel Information



Case Style 'E'
(0.56" x 0.20" Outline)



Case Style 'A'
(0.56" x 0.35" Outline)



Case Style 'B'
(1.00" x 0.50" Outline)

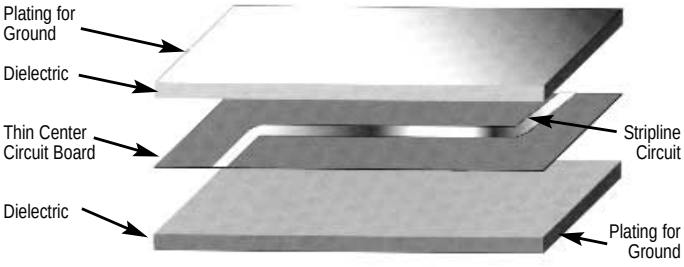
Installation Details for Surface Mount Couplers and Power Dividers

While designed for automated mounting processes (Convection, IR, Vapor Phase and Wave Solder), Xinger® surface mount components can also be used in lower volume applications utilizing manual soldering techniques. This application note discusses coupler mounting requirements and suggests basic mounting criteria.

General Information

The Xinger and RF Power surface mount components are caseless stripline designs using laminated Teflon substrates as shown in figure 1.

Figure 1 - Surface Mount Component Constructionction



Xinger and RF Power components have edge plated channels (castellations) at the ground and circuit connection points for reliable and easy-to-inspect solder joints. Figure 2 shows a 90° hybrid coupler layout with the I/O ports identified. Component symmetry generally allows for either side of the coupler to be the mounting surface. Because the upper and lower surface port corners of the device are connected, care must be taken to avoid grounding or interference from other circuitry in close proximity to these top ports when mounting the coupler. Precautions normally exercised in microstrip design are required. Each page in this catalog identifies a recommended footprint, with a pattern of plated thru holes for optimal performance that can be modified to suit specific design needs.

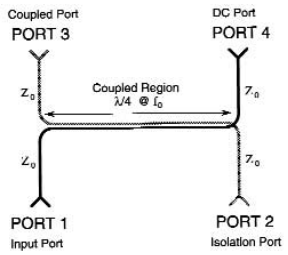


Figure 2 - Hybrid Schematic Diagram

Figure 3 shows a properly mounted coupler (before solder reflow).

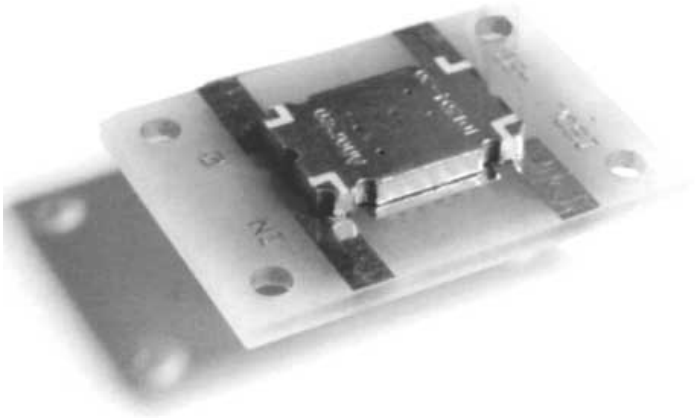
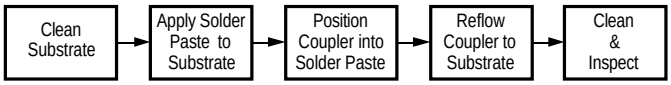


Figure 3 - Properly Mounted Coupler (before solder reflow)

Surface Mounting Hybrid Couplers Process Description:

The process for assembling this component is a conventional surface mount process as shown below. This process is conducive to both low and high volume usage.



Surface Mounting Process Steps

Substrate: Depending upon the particular component, the circuit material has an x and y coefficient of thermal expansion of between 9 and 17 ppm/°C. This coefficient minimizes solder joint stresses due to similar expansion rates as most commonly used board substrates such as FR4, polyimide and G-10 materials. Mounting to “hard” substrates (alumina etc.) is possible depending upon operational temperature requirements. Because of differing dielectric constants, input/output matching may also be required to optimize performance. The solder surfaces of the coupler are all copper plated with a tin/lead exterior plate. All copper plating tanks have strict process controls and are monitored monthly for ductility with all percent elongation numbers registering greater than 16%. Solder masking is recommended to minimize the risk of solder bridging in the ground plane/port locations.

INSTALLATION DETAILS

Solder Paste: All conventional solder paste formulations including water soluble and "no-clean" fluxes will work well with the Anaren Xinger and RF Power surface mount components. Solder paste can be applied with stencils, mesh screens, or syringe dispensers. An example of a manually placed solder paste deposit is shown in Figure 4.

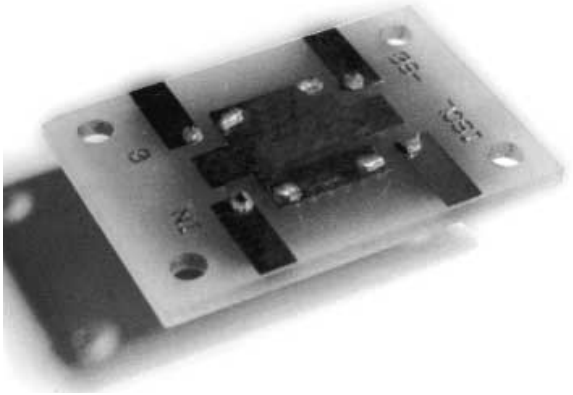


Figure 4 - Manual Solder Paste Deposit on Test Circuit

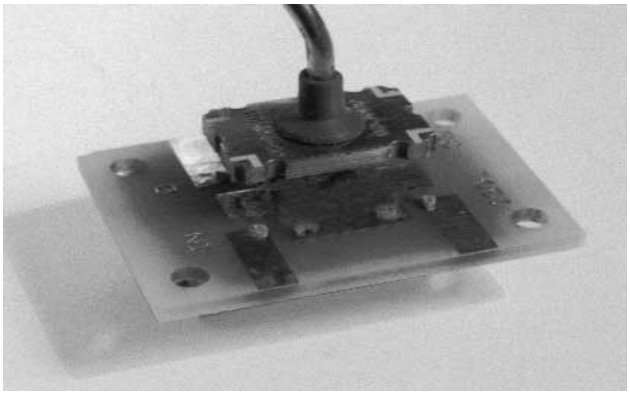


Figure 5 - Component Placement

Coupler Positioning: The surface mount coupler can be placed manually or with automatic pick and place mechanisms. Couplers should be placed onto wet paste with a slight uniform pressure to insure good even adhesion into the paste as shown in Figure 5. When automated pick and place equipment is utilized and vacuum is the holding source, the vacuum source should supply 25" Hg with at least a .060" vacuum mechanism. Parts weigh approximately between 0.3 and 1.3 grams.

Reflow: The surface mount coupler is conducive to all conventional reflow methods common for today's surface mount processes (IR, vapor phase, wave solder, and manual surface mounting). A typical thermal profile for an IR process is shown in Figure 6. Manual soldering of these components can be done with conventional surface mount non-contact hot air soldering tools such as the Leister Model "labor S" or OK Industries model SMT-1160. Manual soldering with conventional irons should be avoided.

Storage of Components: The surface mount components are tin/lead plated. Commonly used storage procedures used to control oxidation should be followed for these surface mount components.

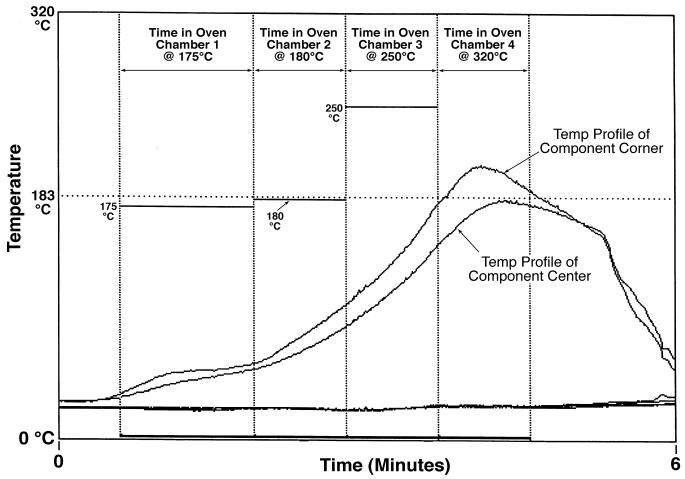
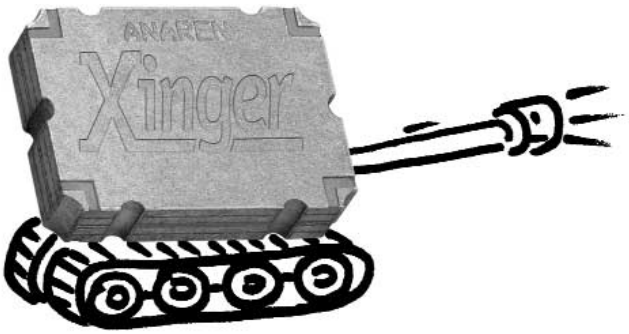


Figure 6 - Solder Reflow Thermal Profile



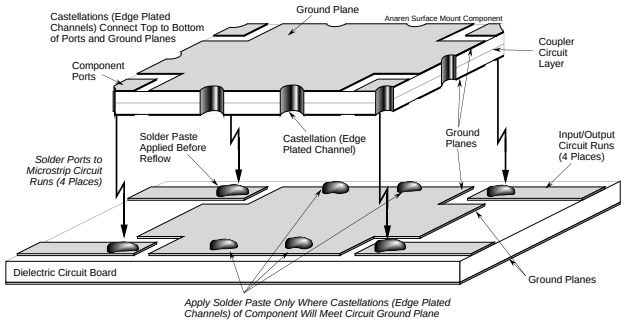
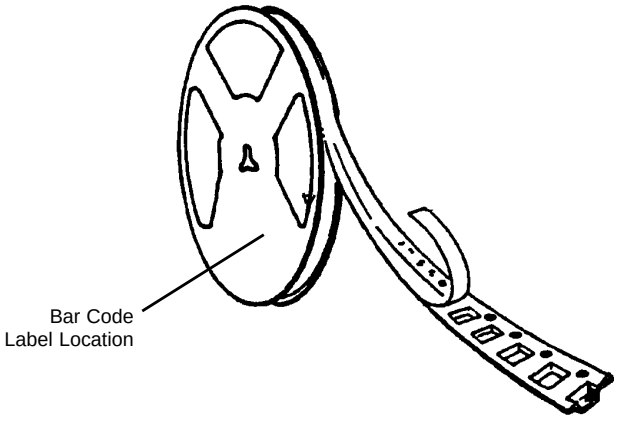


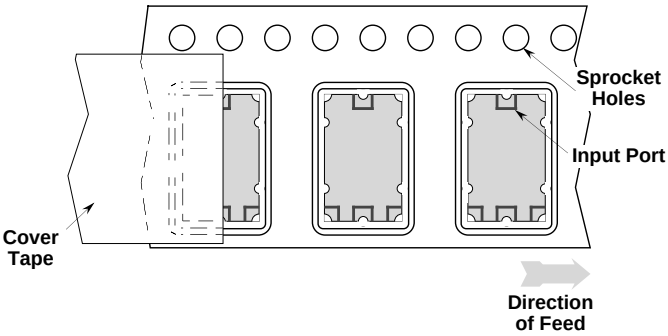
Figure 7 - Mounting features. Example



Tape and Reel General Notes

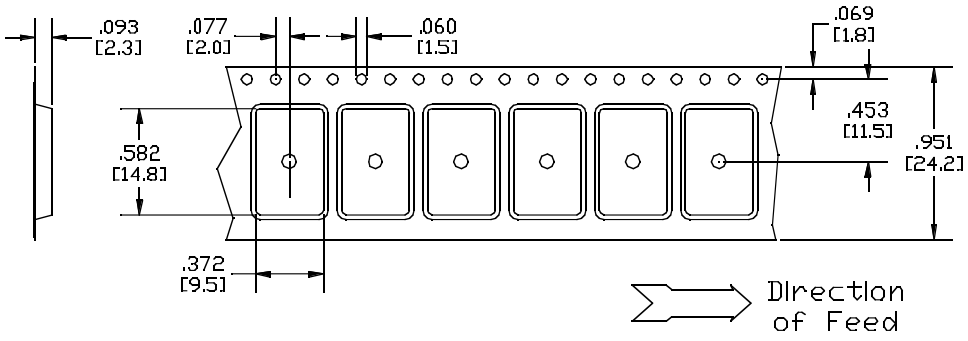
Alignment Of Components

Alignment of components within embossments are symmetrical for all 3dB and directional couplers. Anaren crossovers, balun transformers and power dividers are not 100% symmetrical. For the allignment of the new Xinger crossovers, baluns and RF Power brand hybrids and directional couplers in tape and reel, please refer to sections 2.1, 2.2, 2.4 and 2.6, respectively. The power dividers have specific orientation with input ports near the sprocket holes, as diagrammed (right).



Tape & Reel Orientation of the 2 and 3 way Xinger Power Dividers

Tape and Reel Dimensions



Tape and Reel Dimensions for all 0.56”x0.35” Xinger Hybrid and Directional Couplers and Power Dividers

POWER HANDLING

AVERAGE POWER HANDLING OF XINGER SMT BALUNS, HYBRIDS AND DIRECTIONAL COUPLERS

The average power rating of a Xinger SMT component is a function of 1) the temperature of the internal circuit and 2) the temperature of the external case. As input power is applied to an RF component, some of that power is dissipated as heat. The dissipation rate of the component will, of course, be dependent upon its environment's thermal properties. Therefore, the system in which the unit is to be installed will greatly effect the power handling capabilities of the individual component.

A thermal analysis of the system must be performed in order to determine the system's average power handling capabilities. The discrete surface mount component has a Θ_{JC} (a thermal resistance from the junction to case) and a total system thermal resistance which is the discrete component's Θ_{JC} in series with the thermal resistance from the component's case to ambient (Θ_{CA}). Since temperature is the limiting parameter for any power handling specification, the elements which effect the temperature gradient (ΔT) must be minimized. From equation 3, only dissipated power and thermal resistance effect the temperature gradient. The dissipated power from a Xinger is the difference between the input and output power, from Equation 2, the output power is insertion loss from the input power in terms of decibels (dB).

$$P_{dis} = P_{in} - P_{out} \quad [watts] \quad (Eq.\ 1)$$

$$P_{out} = P_{in} - I.L. \quad [dB] \quad (Eq.\ 2)$$

$$\Delta T = (P_{dis} * \Theta_{JA}) \quad [^oC] \quad (Eq.\ 3)$$

Where:
- P_{dis} = Dissipated (Lost) Power
- P_{in} = Input Power
- P_{out} = Output Power
- IL = Insertion Loss Specification
- ΔT = Change in Temperature
- Θ_{JA} = System Thermal Resistance

The maximum allowable temperatures of the internal circuit and case are 200°C and 150°C, respectively. These temperatures are set by the melting point of the solder and the bonding film used to assemble the stripline package. Once installed, the solder used to attach the component into the system can not be allowed to reflow. Over time as the temperature cycles above and below the solder's melting point, a cold solder joint will form. A cold solder joint is a catastrophic failure, in that the solder joint is stressed to the point that it will no longer conduct electricity. Overall reliablility is improved when temperatures of the circuit and case are held to a minimum.

STEADY STATE THERMAL THEORY

Steady state thermal circuits are analyzed similar to an electronic circuit, compare Eq. 3 with Ohm's law (V=IR), only substituting ΔT for voltage, Pdis for current and ΘJA as the resistance. The dissipated power of the RF circuit directly effects the temperature gradient (ΔT) and the thermal resistance controls how fast ΔT rises with increasing input power. To improve the thermal performance of an RF system, the thermal resistance from the Xinger's case to the ambient heat sink temperature needs to be minimized.

Electronic and thermal circuits have ground potentials, referenced by voltage and temperature, respectively. In specifying a power rating, an ambient temperature, T_o, is required to calculate the system's power handling capabilities. 85°C is a typical specified maximum temperature in commercial designs and for this analysis, will be T_o. The circuit or junction temperature is equal to $T_o+\Delta T$. The outer case temperature will vary depending on the thermal resistance of the external system. Consider a simple electronic circuit with two resistors connected in series with a DC current source applied to one end and ground applied to the other. The overall voltage potential (temperature) is the current (dissipated power) multiplied by the total (thermal) resistance. The potential at the node between the two resistors is dependent upon the ratio of the resistor values, a schematic of this example is shown in Figure 1. A thermal circuit is analogous, with the thermal resistance of each Xinger fixed, the thermal resistance from case to ambient will control the case temperature as well at the total change in temperature, $\Delta T + T_o$.

Inside the Xinger, the thermal resistance is a function of circuit length and width, as well as the thickness and thermal conductivity of the substrate material, ref. (Eq. 4) and (Eq. 5). The stripline construction of a Xinger has two thermal paths which dissipates lost power to ambient.

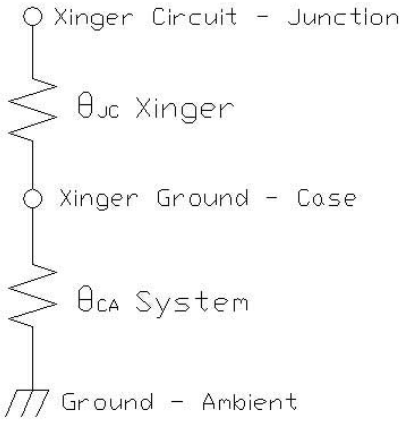


Figure 1 Equivalent Thermal Schematic

Both of these circuits remove the power to ground at 45° angles from the circuit traces as represented in Figure 2. At the center of the stripline package, the thermal paths of each circuit intersects, this intersection point can be represented as a single equivalent trace, shown in Figure 3. Thermally, the heat generated is distributed evenly along the surface area of this equivalent circuit trace. The distributed area of the thermal path is the average cross sectional width of the thermal path in Figure 3 multiplied by the circuit length, ref. Eq 5. Note the thermal path in Figure 2 is identical to the thermal path of Figure 3. This is the mathematical model used for the calculated ΘJC values presented in the specification box for each Xinger balun, hybrid and directional coupler.

$$\Theta = \frac{t}{k*A} \qquad \text{(Eq. 4)}$$

$$A = L(W + t(\cos(45^\circ))) \qquad \text{(Eq. 5)}$$

Where:

- t = Dielectric Thickness
- k = Thermal Conductivity of Substrate
- A = Area of Thermal Path
- L = Circuit Length
- W = Circuit Width
- Θ = Thermal Resistance

POWER HANDLING

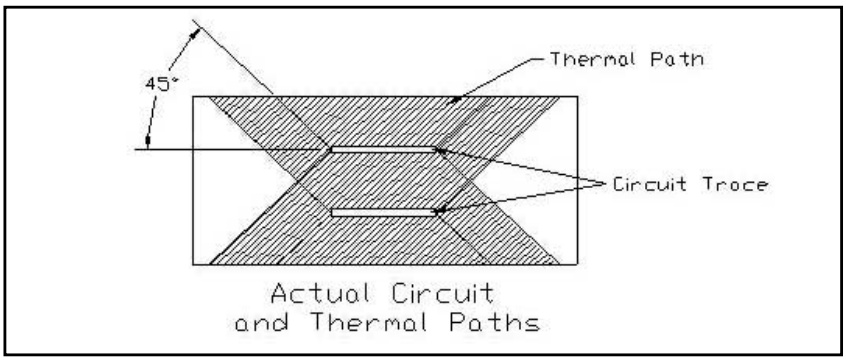


Figure 2

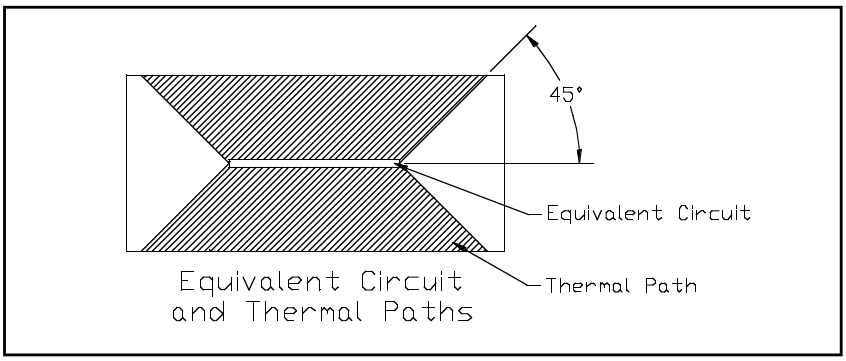


Figure 3

Summary

All Xinger and RF Power designs, regardless of the coupling value, are nearly identical in construction and composition. Circuit and dielectric dimensions rely on the different line impedances required to optimize the electrical performance of each. In general, line widths and dielectric layers are the same for each coupling value, with the exception of the high power units. Frequency and line length have an inverse relationship, as the operating frequency increases, the coupler line lengths decrease. This, in combination with higher insertion loss performance of the higher frequency Xingers is why the power ratings decrese as frequency increases The plated vias connecting the top and bottom ground planes creates a simple parallel thermal circuit and can be represented as such. Using line widths and lengths, dielectric thicknesses and thermal conductivity constants, the thermal resistances for the entire Xinger product line are calculated and presented throughout this catalog.

To get the best performance out of a Xinger, the system designer needs to know all of the thermal characteristics of the system design. For power levels exceeding 10 watts, the thermal path to an ambient heat sink (T_o) needs to be known. If the thermal resistance of the design is too high, there is a risk the Xinger will be exposed to temperatures exceeding the specified limits and will effect the reliability of the design. By following these temperature/power guidelines, circuits may be designed to offer the best performance from Xinger SMT couplers.

Frequently Asked Questions:

General Information

1) 'What is the correct orientation of the Xingers?' or 'Which side is up?' or 'The Xingers appear to be placed randomly in the Tape&Reel or Tube, is this expected?'

The Xinger hybrid and directional couplers are symmetrical by design; the only distinguishing characteristic is the external marking of the components. The Xinger hybrid and directional couplers are placed in Tape&Reel using automated equipment which does not distinguish up from down or left from right. As long as the hybrid or directional coupler is placed in the correct dimensional orientation, it will function as specified. Crossovers, baluns and in-phase power dividers have some inherent asymmetry and are specifically oriented in the tape and reels, refer to each particular component's section for more details.

2) What is the four-digit number that I see on one side of some of the Xinger components?

The Xinger components are manufactured from a large laminated panel in a grid pattern that is cut to produce the final component, the four digit code simply tells Anaren the location from the panel where each part was positioned. This helps in the RF testing of the components as well as check for overall consistency.

3) What are the operating/storage temperatures of the Xingers?

The standard operating temperatures is -55C to +85C, storage temperatures should be held between -65C and +125C. Operating temperatures can exceed +85C, however there will be some degradation in power handling and insertion loss.

4) What is the plating on the Xingers?

The Xinger SMT products are all plated with a thin layer of electrodeposited 63/37 tin/lead plating.

5) Where are the Xinger and RF Power SMT couplers manufactured?

The Xinger components are manufactured in Syracuse NY and the RF Power couplers and resistive products are manufactured in Bohemia, NY on Long Island. The Xinger and RF Power hybrids and couplers are manufactured completely independent from each other which is of tremendous benefit to customers looking for a true second source for the highest volume SMT couplers.

6) Can I use the Xingers in space applications?

The Xinger SMT components are not space qualified and are intended for commercial wireless applications. If the Xinger component is the best option in your specific space application, you can try to implement it in you system but Anaren makes no guarantee as to whether it will work in your particular environment or power levels. However, Xinger components are manufactured from materials and processes that are used in many space programs.

7) What is the size of the Reels used to package the Xinger SMT components?

The reels are manufactured to the EIA-481-2 standard and are manufactured from static resistant materials. Check with Anaren for specific dimensions.

Manufacturing:

8) How large should I make the plated ground vias in my PCB?

Anaren does not recommend specific diameters for the ground vias. However, the preferred diameter should be between 20 and 55 mils, obviously diameter to substrate thickness aspect ratio rules must be obeyed and the PCB designer must determine the specific diameter. Anaren also recommends the via pattern to be as dense and symmetrical as possible about the center of the X and Y plane of the component.

9) During reflow, the Xinger is moves on my board and short circuits to the ground plane, what can I do?

This problem can be cured with improving the design of the ground via and solder paste pattern of the PCB. The most important consideration when designing these patterns is symmetry. The patterns must be as symmetrical as possible, during reflow the solder paste melts and the Xinger floats. Excess solder will wick down into the plated through holes and if the solder and via hole patterns are symmetrical, the Xinger will stay in place. If the solder or via patterns are non-symmetrical, the part may move around during reflow. In the case of a non-symmetrical solder pattern, either the Xinger will not float evenly, or the surface tension of the wet solder will pull on the Xinger resulting in component movement. Similarly, if the via patterns are non-symmetrical the excess solder may wick unevenly producing the part to float unevenly and move the part.

Quality Assurance:

10) What kind of qualification testing did Anaren conduct on the Xinger or RF Power SMT product line?

Contact applications@anaren.com or visit www.anaren.com for a complete report.

11) What is the MTBF/reliability of the Xinger components?

Anaren has evaluated the MTBF of most of the Xinger components against the MIL-STD-217F standard. Below is a list of some of the Xinger MTBF calculated results in a ground benign environment. For other model numbers or environments please send a request via email to: applications@anaren.com

X2A Xinger crossover = 4.902×10^9 hours

X2B Xinger crossover = 2.831×10^9 hours

Xinger 25Ω and 12.5Ω balun transformers = 1.415×10^9 hours

0.20"x0.56" Xinger hybrid and directional couplers = 2.831×10^9 hours

Standard Hybrid and 5, 6, and 10 dB couplers = 2.265×10^9 hours

High power Xinger hybrids = 8.208×10^8 hours

Xinger 2-way in-phase power dividers = 2.286×10^8 hours

FAQ's

Purchasing:

12) Can you place the Xinger Hybrid or directional couplers in a specific orientation in the Tape&Reel for me?

Anaren does not believe that there is any benefit to orient the parts in the Tape&Reel or Tube in a specific direction. This has been done in the past, but there is added cost due to the additional operations involved. Anaren strongly discourages this in practice.

13) I see two or more parts that meet my needs, which one should I choose?

You should consider cost and performance in selecting a Xinger. The smaller the component, the less material it uses and therefore costs less. However, if your AVERAGE power needs are greater than 40 or 50 watts, you may want to consider a larger, higher power component. If you are between choosing a Xinger and an RF Power hybrid or directional coupler, then put both on your bill of materials and use the RF Power component as a second source. The Xinger-RF Power components serve as a true second source as neither component uses any of the same manufacturing processes or materials.

14) Do you have a distributor for the Xinger or RF Power components?

Yes we do. Currently we have Avnet Marketing (www.avnet.com) exclusively distributing the Xinger components and Richardson Electronics (www.rell.com) exclusively distributing the RF Power surface mount hybrids and couplers. Both distribute the RF Power resistors and terminations and they will be more than happy to fill your orders.

15) Can I purchase Xinger and/or RF Power SMT hybrids and couplers directly from the factory?

Anaren has adopted a strong distributorship philosophy and prefer for all of our customers to go through either Avnet or Richardson for all catalog Xinger and RF Power coupler and resistive products.

16) Can you ship Xinger test data with the parts?

Anaren maintains electronic historical data of all Xinger orders within the facility and is monitored on a monthly basis to detect any trends in performance. Currently there is no elegant way for Anaren to provide the data to the customer and if this is an absolute requirement, contact sales@anaren.com. This will only be performed upon request and if data is required on all orders, there will be added cost.

17) When I ordered the Xinger component there was a 'T' or 'R' suffix on the quote (and/or delivery), what is it? What does it mean? Is this correct?

The 'T' or 'R' suffix denotes the type of packaging the Xinger component is shipped in. The 'T' suffix denotes tube packaging and the 'R' suffix denotes Tape&Reel.

18) How many parts come in a Tube? In Tape&Reel?

Tubed parts can be shipped in any quantity. Individual tubes can hold up to 50 parts, depending upon individual component size. For reeled parts, Xingers that are equal to and larger than the 0.48"x0.65" dimension are packaged in 1K quantities and all that are smaller are packaged in 2K quantities.

19) How can I get samples?

The best way for you to get samples of any Xinger or RF Power component is to contact the Anaren representative in your area.

Electrical:

20) I need better performance that what you are specifying, what can be done?

Anaren maintains a historical library of test data for most of the Xinger hybrid and directional couplers and has a statistical retrieval software program that will be able to access this database to determine what the narrow band performance of each part may be and determine how much variation we have measured. We can calculate the mean values with a standard deviation over a narrow band. However, Anaren rarely modifies catalog specifications to meet specialized frequency bands.

21) I can't seem to get your parts to work properly in my assembly, what could be wrong?

The most common problem that is encountered when using the Xinger components deals with ground plane continuity of the PCB assembly and the Xinger. We have found that an ample amount of plated thru holes connecting the top and bottom ground layers of the PCB with a consistent solder joint underneath the Xinger will solve the vast majority of the performance problems. If you still have electrical problems, you may need to go to a grounded coplanar microstrip medium. This may be especially true at frequencies above 2GHz. Also, you must obey standard microstrip design techniques when designing your PCB layout, if the line to and from each RF pad is not the correct impedance or poorly designed, performance of the Xinger will almost certainly deteriorate. Please consult our recommended board layouts and mounting application notes for further details.

22) My simulation requires true s-parameters, do you have any available?

Anaren has test equipment which allows for parts to be fully characterized and de-embedded to the RF interface. The s-parameter files have been taken with the parts mounted to test boards and the board phase length and insertion losses removed. S-parameter files are available for most Xinger and RF Power SMT hybrids, baluns, crossovers, directional couplers and in-phase power dividers at www.anaren.com.